1986 REFERENCE GUIDE

Annual Index of Articles: 1985

ADMIXTURES

How Microsilica Improves Concrete: Microsilica (silica fume), when used as an admixture imparts properties such as very high strength, high density and impermeability to hardened concrete. This article presents considerable information on microsilica's pozzolanic action, compatibility with fly ash concrete, and capability of protecting reinforcement against corrosion. Recent uses of microsilica are cited. **4 pp; 85:327**

Water Reducers: In most concrete mixes, more water is used than is actually needed to fully react with all the cement. The extra water makes the concrete easier to place, but unwanted side effects are that it also lowers strength, increases drying shrinkage and reduces water-tightness. Water-reducing admixtures break up clusters of cement grains and free trapped water so that not as much mixing water is needed to produce a placeable concrete. A table is provided to show how water-reducing admixtures can be used to secure a desired benefit. **3 pp; 85:333**

Flowing Concrete Produced at the Batch Plant: Just a few years ago superplasticizers for producing flowing concrete without adding excess water had to be added to the mix at the jobsite because of problems with early slump loss. Today's products can maintain high slump for 1 to 3 hours and can be added at the batch plant rather than the jobsite. Some of the methods are described for batch-plant production of flowing concrete using one or various combinations (depending on the desired effect) of the seven types of chemical admixtures included in the American Society for Testing and Materials C 494-82 specification. Benefits as well as disadvantages of batch plant addition of superplasiticizers are discussed. **5 pp; 85:337**

Air-entraining Admixtures: Inexpensive Insurance Against Damage Caused by Freezing and Thawing: Size, distribution and stability of the billions of extremely small air bubbles created with the use of an admixture in the cement-water paste are very important aspects of good air entrainment in concrete. If bubbles are too large, there won't be enough of them to protect the paste properly; also, they may break during handling of the concrete. This article discusses the characteristics of air-entraining materials. The potentially harmful effect is noted of water-soluble alkalies in portland cement or fly ash, and of other factors, on the effectiveness of some air-entraining agents. **2 pp; 85:351**

Nonchloride Accelerating Admixtures: This article concerns specifications for nonchloride accelerators and the fact that it may be more to the point to specify *noncorrosive* accelerators. Also discussed are current uses of and alternatives to these agents, their relative effectiveness, ASTM requirements, and cost data. A table shows ACI 212.IR-81 limits on chloride ion allowable in concrete. **4 pp; 85:345**

Special Procedures for Working with Flowing Concrete: When used to produce flowing concrete, a superplasticizer can make placing and consolidating concrete much easier. But how much easier? Must the concrete be vibrated? Does concrete still need to be placed in lifts? How far can the concrete be dropped without segregation occurring? Guidelines, as explained here, on how to work with flowing concrete were developed by the U.S. Corps of Engineers for a large ongoing project in the Middle East. **3 pp; 85:763**

ARCHITECTURAL CONCRETE

Building a Concrete Spiral Stairway: Eight man-months of skilled labor on the formwork paid off for the contractor on this exercise in craftsmanship—building an impressive spiral stairway at the new Cedar Rapids, Iowa Public Library. Detailed descriptions are given of the building of the forms, forming of the stairway soffit, the exacting procedure required for construction of the 3½-foot-high sidewall, and the method of placing concrete for the sidewalls and steps. **4 pp; 85:191**

BASEMENTS

The Bargain Basement: The economics of having a basement in your home are impressive, and contractors could take advantage of this fact by promoting basement construction to their customers. Above-ground space costs $50 to $60 per square foot to construct, depending on one's location; basement space costs about $4 per square foot. By spending $3 or $4 more per square foot to upgrade a basement it can be converted into living or recreation area that might otherwise be unaffordable. Additionally, resale values of homes with a basement are invariably much greater than those of homes without one. **3 pp; 85:609**

BRIDGES

Economical Short Span Concrete Bridges: Statistics show the longest spans to be in the 20- to 60-foot range on about two-thirds of the approximately 300,000 concrete, steel, and prestressed concrete bridges in the United States. Many of these bridges have become either obsolete or unsafe. Whether their replacements should be cast-in-place concrete or precast and prestressed—or a combination of the two—will depend on site constraints as well as local economic and political conditions. These factors are discussed and examples of both types of construction are shown. **6 pp; 85:649**

One-day Erection for Precast Concrete Bridge Arches: A patented concept developed by a Swiss engineer for short-span (up to 40 feet long) highway structures features precasting of standardized arch-shape segments to form an arch-shape bridge. Site work and precasting of bridge segments proceed simultaneously. Using a single crane, final erection of the precast segments typically requires one day or less. When assembly and grouting are completed, the arch formed by these segments is covered with earth fill. **3 pp; 85:659**

BUILDING CODES

Codes and Standards Regulate Formwork Construction: Codes and standards—be aware of what they are and what they say. Four documents dealing with formwork safety are discussed: Part 1926, Subpart Q of the Federal Construction Safety and Health Regulations; the ACI "Building Code Requirements for Reinforced Concrete"; the American National Standards Institute A10.9, "Concrete and Masonry Work—Safety Requirements"; and ACI 347-78 standard, "Recommended Practice for Concrete Formwork." **3 pp; 85:271**

COATINGS

Urethane Anti-graffiti Coating Protects Concrete Soundwalls: Adherence of graffiti materials on concrete walls

MORE

is said to be resisted by application of a urethane topcoat formulated with a release agent that continually migrates to the coating surface. Graffiti is removed by roller or brush application of a water-based paste blended with alkali solvent and detergent that is simply rinsed off with hose water after being allowed to set for 15 minutes. **1 p; 85:362**

COMPOSITE CONSTRUCTION

Composite Floor System Combines Concrete Slab and Open-web Joists: In the system described here, open web steel joists support a reinforced concrete slab, typically 2½ to 3½ inches thick, while it is hardening. The joists and slab then act together to resist live loads on the structure. Construction is simplified because shoring is usually not required and loose plywood sheets are readily stripped for reuse. The composite structural action of the system helps reduce dead load on the foundation and in some cases permits a floor system 2 to 4 inches shallower than others of comparable span and load capacity. **4 pp; 85:437**

CONVEYORS

Concrete Conveyors: Conveyors—the intricacies of their use for mixing concrete on either large or small jobs, characteristics and components of conveyor equipment, types available, the effect of concrete slump on their action, how to use conveyors most effectively, costs of placement by conveyor, and a caution as to what conveyors cannot or should not be expected to do. **4 pp; 85:183**

CORROSION OF METALS IN CONCRETE

Calcium Nitrite Offers Long-term Corrosion Prevention: Corrosion of steel occurs when chlorides penetrate through defects in a protective oxide layer normally found on reinforcing bars. Reportedly, addition of an appropriate dose of liquid calcium nitrite to the concrete mix chemically blocks the corrosive action of chloride salts by stabilizing the protective layer. It is said to repair the defects that usually occur in this oxide structure, thus preventing chloride ions from penetrating to the pure iron metal. Of additional help in preventing corrosion is the use of dense concrete, which can slow the rate at which chloride penetrates to the rebar. **4 pp; 85:355**

CUTTING AND GRINDING

Concrete Saws and Drills: What Can They Do? When Are They Useful?: Descriptions of seven demanding jobs performed by contractors' innovative use of saws and drills. The projects described include creation of chases for wiring and air ducts in the 7- to 8-foot-thick walls during renovation of the Statue of Liberty's pedestal; stitch-drilling 8-foot-deep openings in the floor of the Gatun Locks in Panama; saving $80,000 on the cost of enlarging underwater wall openings in a water treatment plant. On a copper mine project in Arizona, a contractor made his own diamond bits to drill 54-inch-diameter holes in 8-inch-thick precast concrete pipes. **6 pp; 85:741**

Bits and Blades: What Makes Them Cut Faster and Last Longer: A contractor must tell the manufacturer what type of concrete is to be cut on his project and what machine he will be using to cut with. These details will enable the manufacturer to design the best blade or bit for job conditions. Factors that can affect cutting or drilling performance include the types of aggregate to be cut, presence of reinforcing steel in the concrete, cut depths needed, use of coolants, appropriate operating speeds and horsepower needs. An equation is given for estimating costs of cutting. **5 pp; 85:753**

Floors Out of Tolerance Ground Flat: Seven-year-old floors that were bumpy and uneven were ground smooth using equipment developed by the contractor himself: a large grinder with a helical cutting head that could grind ¾ inch off high spots on 500 to 1000 square feet of floor per hour. Two small machines produced the final finish by grinding 1/16 to ⅛ inch off the floor surface. The cost of grinding was less than 70¢ per square foot. **1 p; 85:787**

DESIGN

Design-build Team Influences Building Frame Selection: By forming a design-build team, a structural engineer and a concrete contractor were able to make a winning bid for the entire completed concrete frame of the Embassy Suites North Hotel project in Indianapolis. Design features of the 8-story hotel are described. **2 pp; 85:251**

Who Does the Design Work on a Design/build Project?: After defining what design/build as a construction method really is, this article discusses variations within the method which can produce distinctly different results for certain projects. The fundamental difference may be in the manner a design/build firm executes its design responsibilities, i.e.: using in-house personnel or using design engineers as needed. **2 pp; 85:911**

One Contract Replaces Two or More in Design/build Work: On a design/build job, contractor and architect/engineer work as a team under just one contract with an owner. Advantages discussed include reduced costs and faster project completion, centralized responsibility so there is less chance for misunderstandings between designer and builder, and the contractor has better control of all aspects of project performance. Disadvantages cited by critics are that, in the interests of keeping costs low, creativity of design may suffer and repetitiveness become the norm; minimal design efforts may reduce long-term quality and increase life-cycle costs; and since the design/build contractor is exposed to professional liability for design errors, his insurance costs will be high and must be passed on to an owner. **2 pp; 85:909**

EARTH-SHELTERED CONSTRUCTION

Concrete Arch Supports Earth Blanket Over Sanctuary: The prospect of energy savings of up to 90 percent was the decisive factor behind construction of an earth-covered 80-foot-long by 21-foot-high by 50-foot-wide concrete arch-shaped church in Michigan. The building system used was designed to carry a heavy load of earth. It offered formwork and reinforcement in one piece in the form of modular steel plates weighing 45 to 55 pounds for jobsite assembly. The precurved plates, which formed a reinforced concrete load-bearing shell, were die-stamped from 14-gage steel, cut and corrugated to interlock with the applied concrete (shotcrete). Shoring support was maintained during construction. **2 pp; 85:197**

EDUCATION

What They're Asking About Basics of Concrete: Questions asked of instructors at World of Concrete seminars each year cover many topics. Answers to some of the most frequently asked questions are covered in this article. Basic topics include: concreting materials, concrete construction practices, concrete troubleshooting, concrete testing procedures. Each category covers two to five questions and answers. **3 pp; 85:55**

FIBER REINFORCED CONCRETE

Working With Steel Fiber Reinforced Concrete: Article documents American Concrete Institute recommendations on the use of steel fiber reinforced concrete: How to add steel fiber to the concrete; how much to use; placing and finishing steel fiber reinforced concrete; pumping it; how fibers change the way concrete is handled on the job. **4 pp; 85:5**

FINISHING

Vibratory Screed Requires Only One Operator: An aluminum screed is described that consists of a vibratory screed beam, counterbalance frame, adjustable backpack harness and counterweight. The screed is actually worn on the operator's back. Its beam, which is available in lengths from 6 to 21 feet, is equipped with pnuematic vibrators operated by a small air compressor. The longer the beam, the more vibrators it will require. When wet screeds are used, a skilled finisher should probably operate this backpack screed; but if screed rails or side forms are used, even an unskilled laborer can operate it. All he has to do is walk backward slowly, making sure the screed beam rides on the screed rails. **2 pp; 85:933**

FLOORS

Considerations in Planning and Designing an Industrial Floor: These include: site conditions, traffic requirements and other loads on the slab, method of slab construction, slab

thickness and reinforcement requirements, joint location and spacing. Each of these considerations affects one or more of the others in ways which are summarized briefly in this article. **4 pp; 85:13**

Fibers, Superplasticizer and Iron Hardener Used in Concrete Floor: For the industrial floor described here, fibers were added to the mix at the batch plant in a proportion of 1½ pounds per cubic yard of concrete. Slump tests were done on arrival of each truckload of concrete and enough superplasticizer was pumped into the mix to bring it from a 3- to 4-inch slump to a 7- to 8-inch slump. A ⅛- to ¼-inch layer of dry shake iron aggregate hardener was troweled onto the floor surface about two hours after placing the concrete. After 5 months of use, the only place the floor showed any cracking was at the loading dock, where the concrete was thicker than that for the rest of the floor and probably should have had some rebar reinforcement in addition to the fibers. **2 pp; 85:446**

FLY ASH IN CONCRETE

Fly Ash: What is the recommended amount to use in a mix? What cost savings are possible? What factors can counterbalance some of the cost savings? Types and characteristics of available ashes are discussed, as are the advantages, disadvantages and cautions when using them. Tables serve as guidelines for portland cement-fly ash trial mixes and for cost comparisons of cementitious content of concretes with and without fly ash. Recommended practices are noted for handling and storage of the ashes, attention is given to the effects of weather on setting times, and the preparation and care of test cylinders according to ASTM standards is stressed. **3 pp; 85:321**

FORM RELEASE AGENTS

Fruit Sprayer Does Double Duty for Form Release Agents: An enterprising land development contracting firm in Pennsylvania converted an 18-pound portable fruit sprayer into a form-release sprayer by simply filling its 2½-gallon tank with form release agent. Operator can walk virtually anywhere to spray forms. The contracting firm calculates the sprayer has eliminated about 75 percent waste of form release agent that was happening with its previous equipment. A further benefit is that edges of stacked forms can be sprayed before setup; this greatly reduces cleanup time after the job. **1 p; 85:943**

FORMING

Cast Walls and Slab at the Same Time with Tunnel Forms: Tunnel forms can be used to cast a room's walls and ceiling slab at the same time. Soffit form and wall forms are all one piece of formwork and are erected and stripped as one unit. Use of a half or full tunnel form depends on the width of a room, weight of the forms, and crane capacity. In general, half tunnels are used for spanning wide rooms, full tunnels for spanning narrow rooms. The system has been used extensively for building two-story townhouses in Florida. **3 pp; 85:201**

How to Form Lettering in Concrete: Concrete lettering or numerals for buildings or structures are considered and illustrated in three main groups: precast for freestanding use, precast for application to structures, and cast-in-place integral with a building or panel. Mass-produced forms for standard letters are available commercially in polystyrene, plastic or metal. Those designed for individual jobs can be formed by skilled craftsmen using wood, metal, glass fiber reinforced plastic or plaster. Methods suitable for producing lettering can be extended to creation of other design elements for structural enhancement. **4 pp; 85:257**

Controlled Pours Reduce Wall Form Pressure, Make Better Concrete: The many variables are discussed that designers must consider when determining allowable form pressure for wall forms. American Concrete Institute formulas are provided for calculating wall form pressures. Two methods of placing concrete are illustrated graphically. One is recommended, using hoppers and elephant trunks to assure even placement of concrete in a form. The other is not recommended because it allows concrete to build up in a way that produces high pressures on the form. **2 pp; 85:516**

A Building System Tailor-made for Fast-track Construction: A composite concrete joist and slab construction building system for structural framing was responsible for fast construction of an immense 17-story office building and 8-story parking garage in Dade County, Florida. A diagram shows how precast joists speeded construction by supporting forms for casting floor slabs and eliminating the need for separate shoring. This composite concrete joist system, together with other time-saving methods described and a well planned and rigidly adhered to work schedule, reduced construction time for the structures by at least six months and saved $8500 per day in interest alone, not counting additional revenues realized by early completion of the project. **3 pp; 85:863**

FORMING MATERIALS

Choosing and Using Form Panel Boards: Article concentrates on wood and wood-based panels used as form sheathing. The range of products available is described and some factors are noted to consider in choosing the best one for your job. One should shop around with an eye on the reuse factor; the lowest cost per pour may not come with the cheapest board. **4 pp; 85:237**

FOUNDATIONS

Soggy Site? Don't Wait—Pave With Concrete: Rough, muddy areas with pools of standing water can be dried and stabilized with lime and ready for paving within a day or two. Amounts of lime needed can vary from 5 to 10 pounds per square yard to 25 to 30 pounds for extreme situations. The Federal Highway Administration in Washington, DC is referenced as a source of further information on stabilizing with lime. **1 p; 85:366**

Methods for Achieving and Measuring Soil Compaction: Soil compaction is achieved by application of pressure on the surface or by vibration of the soil mass; soil properties will determine the type of compaction needed. Test methods for determining how much compaction is needed are described and illustrated. Techniques for compacting various soil types are discussed. Suggestions are offered for compaction of small areas in difficult or hard to reach locations, such as against concrete walls and foundations. **5 pp; 85:681**

Swelling Soils Destroy Wood Foundations: Nearly all types of construction are adversely affected by extremely active swelling soils. Damage can be severe and corrective measures will be costly. This article describes what happened to four houses built with wood foundations in an area of South Dakota where the soil contains bentonite, which swells when its moisture content increases. Soils beneath a building are protected from moisture, those outside a foundation aren't. This causes a differential volume change and the resultant swelling pressures can cause considerable damage to walls, doors, jambs and plumbing fixtures. The four houses soon became uninhabitable and the only remedy was to move them off their wood foundations, build concrete foundations in their place and move the houses back onto their intended locations. **2 pp; 85:1033**

HISTORY

America's Concrete Stonehenge: An impressive cast-in-place concrete monument standing on a bluff overlooking Washington State's River Gorge is a close replica of England's Stonehenge, built 4000 years ago. The monument was completed in 1929 as a tribute to brave men who sacrificed their lives at war. Two full-color photos accompany this article. **2 pp; 85:443**

Development of Lightweight Aggregate Concrete: Background information in this article describes the uses of low-strength, natural lightweight aggregates by Roman engineers and designers. Manufacture of high-strength lightweight aggregate began in the early 1900s, with the first commercial use of it being for ships (for World War I) and subsequently for buildings. Notable successful examples of the use of structural lightweight aggregate are cited. For architects, engineers and contractors, true structural lightweight aggregate concrete now has a broad range of applications: tall buildings, thin-shell structures, long span bridges, roofs and decks, and unusual sculptural designs. **4 pp; 85:519**

MORE

The Poor Man's Home and the Rich Man's Palace: This is the saga of a gravel wall house built almost single-handedly in about 1852 by a man named Barrett who had seen the destruction of his wood frame house by fire and determined he would never again have a home that could be destroyed in this manner. The materials used to build the indestructible home were lime, sand, gravel and water. The many details concerning Barrett's time-consuming but effective construction methods were taken from a book he published after completion of the home. Aside from some wooden portions of the home, it is still in good condition and being used as a rental property. **3 pp; 85:571**

LIGHTWEIGHT CONCRETE

Recent Uses of Structural Lightweight Concrete: This concrete weighs at least 30 pounds less per cubic foot than normal weight concrete, yet mixes can be designed to have compressive strengths of up to 9000 psi. A recent study by the Expanded Shale, Clay and Slate Institute showed that its use in floor slabs of steel frame mid-rise buildings can save an average of over $32.00 per cubic yard and in some cases over $90.00. The material has been used to build new bridges and repair or widen older ones. In construction it is used for adding extra floors to existing structures, cutting amounts of concrete and steel required in new buildings, reducing dead weight of large roofs, minimizing dead load of structures on soils with poor bearing capacities, and to achieving greater flexibility in seismic design applications. Notable examples of the use of this concrete are pictured and described. **5 pp; 85:497**

Structural Lightweight Concrete for Bridge Redecking: The use of lightweight concrete for replacing or widening an old normal weight concrete bridge deck often permits the job to be done with minimal modification of the substructure. While production and use of lightweight concrete for this purpose follow most of the same principles as those for normal weight concrete, there are some special recommendations to be considered: Air entrainment is required, the higher water absorption of lightweight aggregate in the mix must be adequately taken into account, and field control must be maintained by frequent testing according to ASTM standards. Advice is given on mix proportion adjustments required to stay within specifications. **4 pp; 85:667**

MANAGEMENT

Common Sense Approach to Borrowing Money: The author, a financial consultant, provides a worthwhile insight into effective techniques for securing a loan from a bank. Some of his suggestions relate to: the importance of brevity in presenting a request, having the facts in hand that the loan officer will want to know immediately, giving potential problems an airing instead of trying to hide them, and—very importantly—having the proposal in writing so the loan officer will not have to rely on his memory of what was said as he subsequently considers the request for the loan. **2 pp; 85:77**

Check Costs on Your Workers' Compensation and General Liability Premiums: Through your own or a specialist's analysis of insurance costs assigned to individual items included in your policy, you as a contractor can often reduce premium costs and even recover sizeable premium overcharges that have been made in the past. Premiums are based on job code assignments and when a code does not accurately reflect the nature of the job assignment, the amount charged under the code frequently is in excess of what it should be. Only an analysis of your premium charges can reveal the overcharges. **2 pp; 85:118**

The Concrete Subcontractor: Managing Project Risks: This three-part article is presented in the following sections: *Part I—The Bid Phase.* Information relates to the importance of a visit to the construction site (preferably coordinated with that made by the prime contractor) and preparation of a written report of the visit, careful review of the many details set forth in the contract documents, and maintenance in corporate headquarters of the project's original estimate, along with subsequent documents (in writing) that pertain to it. *Part II—The Preconstruction Phase.* Subjects covered here are schedule/budget correlation, overhead rates, drawing coordination, submittals, photographs and equipment records. *Part III—The Construction Phase.* Since adequate records are imperative, the final section describes construction diaries, daily project reports, coordination of information and change orders. A system for filing records is outlined. **10 pp; 85:120**

Misinterpretations of Specifications: Attorney McNeill Stokes explains the responsibilities of the design professional, owner or authorized representative, and the contractor in the preparation and interpretation of contracts for construction jobs. Suggestions are given for avoiding legal conflicts, as well as advice about what to do if conflict does develop. Stokes sets forth certain well established rules to be applied for interpretation of meaning in situations where a problem cannot be resolved using the general standard of interpretation. **3 pp; 85:378**

How to Deal with Defective Plans and Specifications: According to Attorney McNeill Stokes, a contractor who enters into an agreement to perform work under owner-drafted plans and specifications has no right to depart from those plans and specifications. But he does have the right to rely on their *accuracy.* The owner who directs the drafting of the plans and specifications for work to be done gives an implied warranty of the plans' sufficiency and accuracy. The owner warranty is breached whenever specifications prove to be defective. Stokes offers straightforward advice to contractors who attempt to perform under defective specifications and incur increased costs. **2 pp; 85:458**

"Or Equal" Substitutions: Attorney McNeill Stokes explains the various implications of the term "or equal" in construction contracts. Recommended procedures are outlined for contractors whose contract does or does not include an or equal clause. Some pitfalls to beware of are brought into focus. **2 pp; 85:524**

Stopping Work: What Are Your Rights?: If a contractor's client doesn't make a scheduled payment, a contractor's first impulse is probably to stop work. But to avoid the possibility of having his action cost him money, the contractor should first thoroughly check his contract to see what his options are on stopping the work legally. McNeill Stokes explains interpretation of contracts, the importance of having a stop-work clause in a contract, and some possibly sticky common-law concepts of *material breach* as used by courts in cases where the contract contains no stop-work clause. The economic disadvantages of continuing work must be weighed carefully against the disadvantages of stopping it. **2 pp; 85:704**

MARKETING

From Production to Construction: To compete more effectively with local asphalt pavers, a ready mixed concrete producer in North Carolina added contracting capability to his ready mix business. While attending a World of Concrete Exposition in Atlanta, he met with and got guidance from the American Concrete Pavement Association and the Portland Cement Association in developing an aggressive sales campaign to create a captive market for his own ready mix. Occasionally now, he may even have to buy some ready mix from another producer; at other times he still supplies it to other contractors. Needless to say, the asphalt business in Roxboro is not what it used to be. **4 pp; 85:61**

Concrete Promotion—Whose Job Is It?: James J. Deters, executive director of the Kentucky Ready Mixed Concrete Association, points out that team work between aggressive ready mix producers and aggressive concrete contractors has produced the most successful promotional efforts sponsored by ready mixed concrete associations. In his experience, the key factor in all successful promotions is a contractor who takes the ball and runs with it. Well executed programs have often failed because, after the euphoria of the seminar or workshop has subsided, there is no qualified or interested contractor around to bid and build the job. **1 p; 85:679**

MATERIAL HANDLING

Handling, Placing and Consolidating Concrete *(Part of a series of articles on the basics of concrete):* The importance of proper planning prior to beginning the construction process

cannot be overemphasized. A pre-pour conference should be held; attendees should include the concrete contractor, architect or engineer as the owner's representative, testing laboratory personnel, and ready mix producer. The conference may be brief, but it should cover safety, concrete mix design, placing rate and truck delivery schedule, inspection procedures, and designation of who is authorized to sign truck delivery tickets, to add water to the concrete and to accept or reject a load. Topics discussed in this article include: equipment, formwork, reinforcement, receiving concrete on the job, placing methods, and correct consolidation or vibration methods. **5 pp; 85:847**

MIX DESIGN

Concrete Materials *(Part of a series of articles on the basics of concrete):* Materials used to make concrete have an effect on how easily the concrete can be transported, placed and finished. This article discusses how the properties of portland cement, aggregates and admixtures affect the plastic concrete as well as the rate at which concrete gains strength, what strength the concrete will ultimately reach, and how well it will perform in service. If these effects are understood, it's easier to specify and order the right concrete mix for pumping, fast form cycling, cold weather concreting or other situations. **4 pp; 85:827**

The Concrete Mix *(Part of a series of articles on the basics of concrete):* A contract may well be awarded to the contractor or ready mix producer who bases his bid or quotation on a concrete mix with the best balance of quality and economy. Meeting job quality requirements with a reasonable factor of safety is only good practice—exceeding requirements beyond anything that can ever be useful is only waste. Bidders who understand the options available in the concrete mix and know how to make the most of them will have the advantage. Four field tests are explained that relate directly to quality of the concrete mix and to control of batching and proportioning of materials. **5 pp; 85:833**

PAVING

Pavement Rehabilitation with Portland Cement Concrete: Article discusses ways of identifying rehabilitation needs and making rehab funds go further. Brief descriptions are provided of repair options: pavement restoration; use of bonded, unbonded and partially bonded concrete overlays (examples are cited); full depth pavement replacement using recycled concrete as aggregate in the new concrete or as granular material for new subbase. Required overlay thickness, joint treatment, and reinforcement cover are discussed briefly. **6 pp; 85:413**

Whitetopping an Asphalt Parking Area: Application of a 3- to 4-inch concrete overlay on a deteriorated asphalt parking lot will increase the lot's load carrying capacity and provide a clean, safe surface. Such an overlay is easy to design. Portland Cement Association publications, *Thickness Design for Concrete Highway and Street Pavements,* and *Building Quality Concrete Parking Areas* are referenced as sources of useful data for designers of such overlays. A successful example of the speedy rescue of a large asphalt parking lot in Indiana is described. **3 pp; 85:425**

Milwaukee Prevents Pavement Scaling: This is a description of Milwaukee's firm control of construction standards and air entrainment requirements that have provided the city with nonscaling, durable concrete pavements for 40 years. Article includes a table that lists the city's specifications for concrete pavement construction and contrasts them with common practices in private concrete work. Photos illustrate the unmistakable difference in quality of paving done by the city and that done by private contractors. **4 pp; 85:431**

Thicker Pavements Are a Better Buy for the Taxpayer: Pavements don't have to be retired at the presently accepted age of 20—they could live to be 40 or 50 despite the longer, heavier and more numerous trucks using them today. Studies reported here demonstrate that pavements designed one or two inches thicker last longer and can carry two to three times as many load repetitions. The increase in cost for the added thickness is small. **2 pp; 85:456**

Prison Streets Built with Prison Labor: Sophisticated concrete placing equipment is not in evidence on the grounds at Kansas State Penitentiary where streets, sidewalks and parking areas are being constructed. That's because inexpensive, unskilled labor is readily available; selected inmates with minimum security clearance are given on-the-job training to do the work. Initial training of the inmates was done by Portland Cement Association engineers and personnel from Geiger Ready Mix Company of Leavenworth, Kansas who showed a film on the basics of concrete and on how to use various equipment. Turnover in the work force is sizeable and construction proceeds slowly, but there are benefits with this type of project: inmates learn a skill that may be useful to them on release from prison, the work keeps them busy, and the state's cost for concrete work is low. **2 pp; 85:527**

PRECASTING

Precast Slabs and Columns Make a Demountable Partition-free Building: A patented building system is described that consists of two standardized building units—precast slabs and columns—for building offices, schools, hospitals and other nonresidential facilities. Slab and column tolerances are such that the pieces can be moved from the transport vehicle directly to the point of use on the site with satisfactory fit assured. Pieces can later be taken apart and reassembled into an entirely different building. Completed structures have no load bearing walls to disrupt available floor space, there are no beams or joists that cut into available headroom, and interior partitions can be laid out with respect to column spacing modules only. The system was developed in the Netherlands; adaptations of it reportedly make the structures earthquake resistant. **1 p; 85:523**

PRESTRESSING

Prestressed Concrete Poles: The worldwide uses for prestressed concrete poles today are indeed numerous, as are the shapes in which they can be fabricated either on-site or in a precasting plant. Design considerations to accommodate for the various axial and bending loads to which poles are subjected are documented. Methods of manufacture are described: centrifugal precasting, Mensel's production line technique, and the long line method—which is perhaps the most common. **3 pp; 85:245**

PUMPING

Concrete Pumping: Pumps can be used profitably even on many relatively small jobs. This article deals with trailer-mounted pumps and truck-mounted pumps with placing booms. Advice is given on choosing the right pump and basic requirements are discussed for getting maximum benefits from dollars spent on pumping. Requirements include a level site for the pump, room to get ready mix trucks in and out, timely delivery of a pumpable concrete, and enough people on the placing and finishing crews to handle the concrete. **3 pp; 85:177**

Pumping Structural Lightweight Concrete: Three notable examples are cited of the successful pumping of this concrete—to a record height of 1030 feet on one job. The contractors and ready mix producers on all three projects agreed that by far the most important single factor in producing pumpable lightweight concrete is the adequacy of aggregate presoaking. Predominantly, this article deals with the effect of presoaked aggregate on slump, methods for measuring aggregate absorption during presoaking, and four methods of achieving adequate presoaking. Procedures for pumping are little different from those for pumping normal weight concrete. Mix designs and the importance of field testing before a job begins are discussed. **4 pp; 85:505**

Cleaning Out High-rise Pumplines: When pumped concrete is used on a high-rise project, an efficient line cleanout method is needed. A separate cleanout station set up at the jobsite can make line cleaning easier and simplify disposal of waste concrete. Three drawings illustrate various aspects of a proper cleanout station setup, and the details of their functions are explained. Because careless procedures during cleanout can cause problems and even serious injury, safety precautions are stressed. **2 pp; 85:925**

MORE

READY MIXED CONCRETE

Confrontations—Who Needs Them! (Editorial): Guest editorialist is James J. Deters, executive director of the Kentucky Ready Mixed Concrete Association. His suggestions for ready mix producers include: improving the quality of their product by following American Society for Testing and Materials (ASTM) standards; opening lines of communication to develop mutual respect among owner, designer, contractor, testing lab and ready mix producer; and insisting on a prejob meeting to determine requirements before starting *any* project. **1 p; 85:263**

Pre-pour Conferences: A fictitious case illustrates why pre-pour conferences are necessary for heading off problems before concrete placing begins. Ideally, job specifications should be the instrument through which problems are avoided and the basis for resolving questions that arise. This will not be the case, however, unless architect and/or structural engineer, general contractor, concrete subcontractors, concrete producer and testing laboratory interpret the specifications in the same way. Hence the importance of a pre-pour conference to help uncover any contradictory provisions and to improve communication among the parties involved. **3 pp; 85:265**

Preparation for Ordering Concrete *(Part of a series of articles on the basics of concrete):* Contractor, ready mix producer, and owner or specifying engineer all share the responsibility for delivering a concrete mix that meets all specification requirements and the contractor's needs. Each party must be thoroughly familiar with the contents of the specification and all three must be in aggreement on its interpretation. It could be advantageous for the contractor or ready mix producer to make suggestions to the specifier prior to the bid—by far the most convenient time for changes. For changes to be accepted, many engineers need only to be approached properly with adequate documentation of the quality and economy that could be expected. This article discusses details of checking the specification preparation at the jobsite and ordering the concrete. **4 pp; 85:841**

REINFORCEMENT

Mechanical Splices of Reinforcing Bars: The many types of modern mechanical splicing devices are illustrated with drawings accompanied by comprehensive explanations about their use. Compression and tension splice devices are described, as are ways of splicing rebars at construction joints. Reader comments and additional information on mechanical splices appear on page 395 of our April 1985 issue and on page 720 of our August 1985 issue. **5 pp; 85:23**

Grout-filled Metal Sleeve Splices Rebars: A rebar splicing device developed originally to connect precast concrete members is now being used for cast-in-place construction as well. This article provides a description of how a metal splice sleeve is filled with grout that provides a mechanical bond between rebar deformations and grooves on the inside of the sleeve. Such sleeves have also been used to reduce restraint forces in post-tensioned slabs and in tilt-up work as moment connectors at the foundation, connecting tilt-up panels to foundation dowels. The splicing method has gained acceptance by the International Conference of Building Officials. **2 pp; 85:929**

RENOVATION

Limestone Meets Its Match: Precast lightweight concrete panels were used successfully for exterior facing when six stories were added to a 12-story, 80-year-old limestone-faced building in downtown Chicago. The finished panels blended well with the limestone facing on the 12 original stories and the job cost half as much as would have been the case had limestone been used. **2 pp; 85:868**

REPAIRING

How to Fix Cracks: Important questions: Is the crack moving and growing or is it dormant? Are structural repairs required, or will just sealing be enough? Crack repair methods are summarized. The article discusses and illustrates what types of cracks can be repaired with each of the following procedures: epoxy injection, routing and sealing, stitching, adding reinforcement, drilling and plugging, grouting, flexible sealing, drypacking, polymer impregnation, overlays and surface treatments. **5 pp; 85:37**

Waterblasting Robot Helps Complete Bridge Repair 14 Months Early: A bridge near Grand Island, New York needed to have 75,000 square feet of deteriorated surface concrete removed to a depth of 1 inch below its top reinforcing steel; 18 months had been allowed for construction. With the use of a waterblasting machine that consisted of a power unit, remote control and robot, the job was completed in 4 months. Special features of this equipment are described, as are techniques the contractor used in completing the job so far ahead of schedule. **2 pp; 85:785**

RESIDENTIAL

Why Don't We Build More Concrete Homes?: The technology is ready; business-related factors, including marketing and construction management, must be brought into line. Seven factors are discussed that impede adoption of cast-in-place (as well as precast) concrete housing in the United States. Most of the impediments lie in a lack of contractor know-how, inadequate effort to develop institutional and consumer acceptance of concrete for housing, and inadequate marketing programs in the many segments of our industry. *Yet concrete for housing offers the number one opportunity for expansion of our market.* **3 pp; 85:565**

How Many Ways to Build a Concrete House?: Descriptions and photos of 14 concrete homes are preceded by a discussion of high-tech innovations in design, formwork, concrete placing, reinforcement, and insulation that enable builders to offer better values and faster construction schedules. Some of the homes featured include: a twelve-sided module with exposed aggregate wall panels; an earth-covered residence constructed with the use of inflated forms and covered with reinforced shotcrete; a two-level home with walls, roof, floor and window wells made of prestressed double tees; a single-pour round house that adapts to difficult sites; three-story townhouses featuring industrialized construction with cast-in-place concrete and a sizable price advantage; super insulated homes for fuel economy. **19 pp; 85:577**

More Ideas for Concrete Homes: This is a review of several residential construction systems and concepts that have been featured in previous CONCRETE CONSTRUCTION articles. The brief descriptions of those systems and concepts are accompanied by references to the initial articles, which offer full information. **4 pp; 85:603**

Many Thanks to All Who Contributed to the Showcase of Concrete Homes: Brief descriptions are given for 35 examples of the use of concrete for residential construction. The items were submitted by our readers and industry representatives over the United States for use in the article titled "Showcase of Homes" (July 85, page 577) but space did not permit inclusion of full information. Many of the examples are illustrated, and all names and addresses of the people who submitted them are furnished. **9 pp; 85:613**

How Many Ways to Build a Concrete House?: Carried over from CONCRETE CONSTRUCTION's July special issue on residential concrete, three more examples of this type of construction are featured under the following titles: "Concrete Cabin Cast in Place by Owner-Builders Working on Weekends" (**2 pp; 85:675**); "Small Textured Concrete Panels Shape Insulated Wall for World of Concrete Demonstration House" (**2 pp; 85:676**); and "Dome of Steel-fiber-reinforced Shotcrete and Urethane Offers Energy-efficient Living Above Ground" (**2 pp; 85:724**).

What Every Homeowner Should Know about Concrete *(Part I of a series on residential concrete):* Probably one of the most fundamental things to understand would be the importance of using the right concrete and hiring a quality-minded contractor to do the job. Discussion in this article centers on what makes good quality concrete, typical concrete requirements for around-the-house flatwork, steps to take during construction to ensure good performance, how curing should be done, and finding a good contractor. **3 pp; 85:771**

***Residential Formwork** (Part II of a series on residential concrete):* Factors covered relate to choice of formwork for maximum economy, designing and erecting the type chosen, loads formwork must be able to support, form ties that will be adequate to resist lateral pressures exerted by freshly placed concrete, precautions in the choice of a form coating or release agent, proper procedures for erecting formwork, removal of forms and supports. Article includes a checklist of considerations for use in planning formwork, plus tables on American Concrete Institute suggested tolerances for residential concrete and on maximum lateral pressure for design of wall forms. **4 pp; 85:915**

SAFETY

Tell Customers about the Possibility of Cement Burns: The point is made that although cement burn cases and lawsuits aren't rampant in the concrete construction industry, this is small consolation if your company happens to be on the wrong end of a suit. To protect customers from injury and companies from lawsuits, ready mix concrete producers would be well advised to properly alert customers to the possibility of cement burns. A sample warning card pictured with this article illustrates one means of helping prevent such burns. **1 p; 85:74**

Solidification of Hazardous Wastes Using Portland Cement: Use of cementitious materials to solidify hazardous substances in disposal dumps, pits and ponds has recently shown considerable promise. Solidification involves use of portland cement, proprietary additives and in certain cases, fly ash; suitable mix designs will depend on the chemistry and concentration of the waste. The Portland Cement Association's Construction Technology Laboratories Division and several commercial concerns have developed mix design systems that can be tailored for particular waste materials and situations. **3 pp; 85:781**

Cement-bentonite Slurry Walls Limit Seepage: A method is described for constructing cement-bentonite slurry walls that have performed successfully as nonstructural underground barriers against seepage into or out of areas such as sanitary landfills, hazardous waste impoundments and dams. Typically, a slurry will contain about 18 percent portland cement, 6 percent bentonite and 76 percent water. In combination with water, dry bentonite swells to as much as 10 to 12 times its original volume, and with the addition of cement the slurry sets to a higher density than can be achieved using soil rather than cement in it. Set usually begins within 2 to 3 hours. Recommended equipment and methods for use on various widths and depths of trenches are explained. **3 pp; 85:939**

TESTING

Test Kit for Analyzing Water or Detecting Rebar Corrosion: A portable test kit is available that contains special papers and liquids for on-site determination of the presence of various potentially harmful salts in water samples. A few examples of other tests that can be made include determination of the pH of water within ± 0.5 unit, checks for possible corrosion of rebars through detection of iron salts in the concrete, measurement of chloride concentrations in older concrete structures. **1 p; 85:364**

A Proposed Test to Determine the Cracking Potential Due to Drying Shrinkage of Concrete: The test is designed to evaluate quantitatively the effect on drying shrinkage cracking in the field when a single material or condition is changed. Freshly cast control and test panels are exposed simultaneously to a set of severe conditions designed to cause cracking. The two panels are alike except for alteration of a single material in the test panel. The effect of that alteration can be studied within a matter of hours, with complete results normally available within 24 hours. The method permits evaluation of many factors. **4 pp; 85:775**

TILT-UP

Tips on Tilt-up Mini Storage Facilities: This pictorial article describes, explains and illustrates design and construction procedures developed by the Portland Cement Association for construction of tilt-up mini storage facilities. Major illustrations include: design data, subgrade footings, floor slabs, forming wall panels and creating exterior finishes, panel reinforcement, erection of walls, bracing, panel joints and connections, roof systems, and insulation. Because crane time is a major cost item, suggestions are offered for lifting panels most efficiently. **4 pp; 85:511**

TOLERANCES

An Immediate Practical Approach to Floor Tolerances: The author urges architects and engineers to prepare their plans and specifications for floor tolerances realistically, using the knowledge and experience presently available. Two factors that should be borne in mind are that the American Concrete Institute's standard tolerances are too tight for most jobs and that they have seldom been achieved. The relatively few situations are cited where superflat floors are really needed. **2pp; 85:66**

TROUBLESHOOTING

***Common Field Problems** (Part of a series of articles on the basics of concrete):* Methods of prevention and remedial actions for the common field problems presented here relate to: bleeding, harsh or sticky finishing, low air content, slump adjustment, setting time variations, and plastic cracking. Also covered are hardened concrete shrinkage cracking, pavement scaling, dusting of floor surfaces, surface checking, and low concrete strength test results. **5 pp; 85:855**

VIBRATION

How Do Blasting, Jarring, and Other Shock Vibrations Affect Fresh Concrete?: An extensive program evaluated the effects of blast- or earth-borne vibration on the compressive, shear, and reinforcement bond strength of green (newly placed) concrete. No evidence was found that the shock-vibrated concrete tested in this study was structurally inferior or that it would produce a less durable structure. The results are at variance with previously held assumptions about limitations on allowable vibration. As a consequence, present limitations have been significantly relaxed. **2 pp; 85:214**

WALLS

Wall Placement Technique Speeds Construction: Essentially a 140,000-square-foot underground box, American Airlines' new baggage handling facility at Chicago's O'Hare Airport had to be built as speedily as possible. This article describes the excavation retention system, waterproofing and wall construction techniques employed. Key elements contributing to rapid building progress were bentonite panels for waterproofing and a combination of shotcrete and cast-in-place concrete for walls. **2 pp; 85:691**

WATERPROOFING

Waterproofing Warranted for 10 Years: A recently introduced complete waterproofing system for newly built exterior basement walls includes a polymer-modified asphalt coating material for airless spray application by personnel trained and certified by the coating manufacturer. In addition to possessing a unique crack-spanning capability, the coating material reportedly rates high in the usually expected properties of a waterproofing coating, has excellent adhesion to concrete and resistance to degradation. It can be purchased only as part of the total waterproofing system for application by manufacturer's trained personnel. **2 pp; 85:450**

Corrections for Items Published During the 1985 Volume Year

Soggy Site? Don't Wait—Pave With Concrete, April, page 368, line 8. The text should read ". . . *sawed at 10-foot intervals in both directions.*"

Bits and Blades: What Makes Them Cut Faster and Last Longer, September, page 753. Operating speeds for saw blades given in *surface feet per minute* (SFPM) are listed incorrectly in Figure 4. The correct speeds in SFPM are: 12,000 to 15,000 for asphalt, brick or block; 10,000 to 12,500 for soft concrete or hard asphalt; 9,000 to 11,000 for medium concrete; 8,000 to 10,000 for hard concrete; and 7,000 to 9,000 for reinforced concrete. Speeds given in *revolutions per minute* (RPM) are listed correctly. Figure 4 will be completely reprinted in the January 1986 issue with the correct figures for SFPM.